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**UNITED STATES PATENT AND TRADEMARK OFFICE**

Application of: Weislaw BOBER  
Appl./Serial No.: 10/722,227  
Filed: November 25, 2003  
TC/A.U.: Unknown  
Examiner: Unknown  
Docket No.: 1173.1009  
Title: COMPOUND LIFT DEVICE

**PETITION TO MAKE SPECIAL UNDER 37 C.F.R. § 1.102**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

July 15, 2004

Sir:

Pursuant to 37 C.F.R. §1.102 and in accordance with section 708.02 VIII of the Manual of Patent Examining Procedure (MPEP), entitled Accelerated Examination, Applicant hereby respectfully submits a Petition to Make Special for the above identified patent application.

Applicant presents all claims directed to a single invention. If the Patent and Trademark Office determines that all of the claims are not obviously directed to a single invention, i.e., the apparatus of claim 1 and the method of claim 4 are deemed to be two separate inventions, then

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Applicant will make an election without traverse of claims 1 to 3 directed to an apparatus as a prerequisite to the grant of special status.

The following documents are enclosed in support of this Petition:

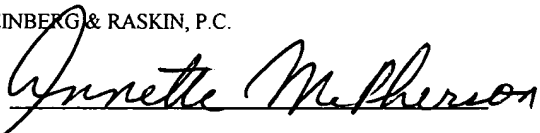
1. A copy of the above identified application including all claims directed to a single invention.
2. A statement including a pre-examination search listing the field of search by class and subclass.
3. A copy of each reference deemed related to the subject matter encompassed by the claims of the above identified application.
4. A detailed discussion of the references pointing out how the claimed subject matter is patentable over the references.
5. A check in the amount of \$130.00 pursuant to 37 CFR 1.17(h).

Accordingly, it is respectfully requested that the U.S. Patent and Trademark Office grant this Petition to Make Special for the above identified application.

I hereby certify that this correspondence and/or fee is being deposited with the United States Postal Service as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" on July 15, 2004.

STEINBERG & RASKIN, P.C.

BY:



### **STATEMENT OF FIELD OF SEARCH**

A pre-examination search for the above-identified application was conducted in Class 108, Subclass 147 and Class 312, Subclass 21.

### **BRIEF DESCRIPTION OF THE PRESENT INVENTION**

The present invention is directed to a motorized lift facilitating the controlled and nearly noiseless movement of a flat panel television in both an upward (extended) direction and in a downward (retracted) direction. The lift of the present invention is comprised of a base unit, an intermediate unit, and a support unit. The base unit, intermediate unit and support unit are slidably disposed in a telescoping fashion in the described order. A first pair of linearly extensible slides is fastened between base and intermediate units and a second pair of linearly extensible slides is fastened between the intermediate and support units. The intermediate unit is extended and retracted from the base unit in a linear fashion via a single motor driven screw. The support unit is extended and retracted in a linear fashion via a cable-pulley arrangement that couples movement of the intermediate unit to the support unit in a likewise direction.

The base unit is comprised of a plate of planar extent and a first pair of linearly extensible slides separately disposed and parallel. A linear slide is fastened to each length-wise flange along the base unit.

The support unit is comprised of a plate of planar extent and a second pair of linearly extensible slides separately disposed and parallel. A linear slide is fastened to each length-wise flange along the support unit. At least two support elements are adjustably fastened to the support unit so as to facilitate secured attachment of a flat panel display.

The intermediate unit is comprised of a plate of planar extent, a first pair of pulleys attached at one end, and a second pair of pulleys attached along a second end. First and second pairs of linearly extensible slides are separately fastened to the intermediate unit so as to allow movement between intermediate and base units and between support and intermediate units.

A reversible motor is fastened to the base unit and coupled to a drive screw. The drive screw is secured to the base unit so as to allow its rotation. The drive screw contacts the intermediate unit, thereby imparting linear movement to the intermediate unit via rotation of the drive screw. Thus, the intermediate unit extends from and retracts relative to the base unit. The intermediate unit is disposed between base and support units when the compound lift is retracted.

A pair of cables are separately disposed and parallel about the drive screw. Both ends of each cable pair are fastened to the base unit. Each cable pair is further connected to the support unit. The cables are slidably disposed about the intermediate unit via pulleys. The cables impart movement to the support unit when the intermediate unit is extended and retracted.

Typically, the dimensions of a television cabinet are dictated by the lift arrangement

rather than by the size of the television to be lifted, thereby favoring volumetrically inefficient cabinet designs. The telescopic design of the present invention preserves economy of space in cabinet design. Additionally, the dual pulley system of the present invention enables active and controlled extension and retraction of the support unit. It is important that the extension and retraction be active and controlled, i.e. not dependant on gravity, so that the support unit may be extended and retracted even if the weight of a flat panel monitor were to cause the support unit to tilt several degrees from normal (90 degrees).

### **DISCUSSION OF THE REFERENCES**

The following U.S. Patents revealed in the search of the prior art were deemed to be related to the subject matter of the claims: 4,752,102, 4,568,132 and 6,494,150. Copies of these U.S. Patents are enclosed herewith.

#### **U.S. Patent 4,752,102**

U.S. Patent No. 4,752,102 to Rasmussen (hereinafter "Rasmussen"), entitled "Elevating and Supporting Apparatus", issued on June 21, 1988. Rasmussen discloses an elevating and supporting apparatus comprising a motor driven, vertically extending screw, which acts to raise or retract a telescoping cage from a base cage. A stated object of Rasmussen is to provide a means for eliminating sliding contact between guide surfaces, hence eliminating expensive precision machining. Accordingly, Rasmussen discloses a telescoping cage and a base cage. The

telescoping cage is stabilized by a rolling means that attaches to a guiding means mounted on the base cage.

The present invention is directed to the movement of a support unit via a combined pulley and motor system. The motor system functions to impart linear movement to the intermediate unit via rotation of a drive screw. The pulley system functions to impart further linear movement to the support unit when the intermediate unit is extended or retracted. Rasmussen does not disclose a combined pulley and motor system for movement of a support unit. Rather, Rasmussen discloses an elevating means comprised solely of a motor that functions to drive a vertically extending screw.

The combined pulley and motor system of the present invention also functions to impart cooperative linear movement to the intermediate and support units. That is, as the drive screw raises or lowers the intermediate unit, the pulleys operate to move the support unit in simultaneous motion with the intermediate unit. Rasmussen discloses a three-tiered embodiment of the telescoping cage in Figs. 1 and 3, but does not disclose cooperative linear movement of the second and third tiers. Rather, the three tiered embodiment of Rasmussen discloses movement of a second telescoping cage via a first drive screw and independent movement of a third telescoping cage via a second drive screw.

The present invention further includes a base unit, an intermediate unit, and a support unit, wherein a motor, coupled with a drive screw, extends the intermediate unit with respect to

the base unit, and two cables fastened to the base unit and disposed about the intermediate unit via two pulley pairs impart movement to the support unit when the intermediate unit is extended. Thus, the intermediate unit of the present invention is extended and retracted from the base unit via the drive screw, whereas the support unit is extended and retracted, in a likewise motion, from the intermediate unit via the described pulley system. As discussed, Rasmussen does not disclose a pulley system. Rather, Rasmussen discloses an elevating means comprised solely of a motor to drive a vertically extending screw. Accordingly, Rasmussen does not disclose a combined pulley and motor system for movement of a support unit, much less a motor associated with a drive screw for extending such an intermediate unit with respect to a base unit, and two cables fastened to the base unit and disposed about the intermediate unit for imparting movement to the support unit when intermediate unit has been extended or retracted.

Accordingly, for at least these reasons, Rasmussen fails to anticipate or obviate the present invention.

#### U.S. Patent 4,568,132

U.S. Patent No. 4,568,132 to Watt (hereinafter "Watt"), entitled "Motorized Lift Mechanism", issued on Feb. 4, 1986. Watt discloses a lift mechanism that provides for movement of a platform vertically within a cabinet between an upper or use position and a lower or storage position. The Watt platform is mounted on a pair of guide shafts and is raised and lowered by means of a drive shaft. The electrical controls defining the extent of vertical



movement of the platform are arranged for movement therewith. Watt further features an improved mechanism for interconnecting the platform to a lid of the cabinet in a manner serving to prevent pinching the fingers of a user between the lid and the front of the cabinet.

As discussed above, the present invention is directed to movement of a support unit via a combined pulley and motor system. The motor system functions to impart linear movement to the intermediate unit via rotation of a drive screw. The pulley system functions to impart linear movement to the support unit when the intermediate unit is extended or retracted. Watt does not disclose movement of a support unit via a combined pulley and motor system. Rather, Watt discloses movement of a platform solely by means of a guide shaft.

Additionally, the present invention is directed to a base unit, an intermediate unit, and a support unit, wherein a motor, coupled with a drive screw, extends or retracts the intermediate unit with respect to the base unit. According to the present invention, two cables fastened to the base and support units and disposed about two pulley pairs fastened to the intermediate unit impart movement to the support unit when the intermediate unit is extended or retracted. Watt does not disclose a base unit, an intermediate unit, and a support unit, let alone a means for extending the intermediate unit with respect to the base unit, wherein two cables are fastened to the base unit and disposed about two pulley pairs, which are fastened to the intermediate unit, imparting movement to the support unit when the intermediate unit is extended or retracted.

Accordingly, for at least these reasons, Watt fails to anticipate or obviate the present

invention.

U.S. Patent 6,494,150

U.S. Patent No. 6,494,150 to Phoenix et al. (hereinafter “Phoenix”), entitled “Elevating Apparatus for Visual Displays”, issued on Dec. 17, 2002. Phoenix discloses an elevating apparatus comprising a base unit upon which a motor is mounted, a first pair of fixed vertical smooth rods, and a pair of vertical threaded rods. The motor rotates the threaded rods in synchrony. The rotation of the threaded rods causes the raising and lowering of a nut disposed on each of the threaded rods. A first pair of sliding bushings disposed on the first pair of smooth rods are connected to the nuts and are lowered and raised in combined movement with the nuts. A platform that supports the display device is attached to the bushings and moved therewith.

In a second embodiment, Phoenix discloses a second pair of vertical smooth rods for raising a platform above the threaded rods. The second pair of vertical smooth rods is disposed in linear fashion, adjacent to the first pair of vertical smooth rods. The second pair of vertical smooth rods has a second pair of bushings attached thereto. In this embodiment, the platform that supports the display device is attached to the second bushing pair. The second pair of vertical smooth rods have a pair of sprockets rotably mounted thereto. The second pair of vertical rods raise and lower with movement of the threaded rods due to a horizontal cross bar attached to the second pair of vertical rods. Thus, movement of the threaded rods causes movement of the threaded nut together with the first bushing pair, the horizontal cross bar, and

the second pair of vertical smooth rods. A chain, attached at a first end to the base and at a second end to a second bushing, functions to raise the platform above the top of the threaded rods and other vertically fixed elements. The platform is retracted by force of gravity, when the threaded nuts are retracted.

The present invention is directed to movement of the support unit via a pulley system. The pulley system comprises a pair of cables and two pairs of pulleys. Each cable of the cable pair is arranged about one side of the drive screw. The two ends of each cable are fastened to the base unit. Each cable is further fastened to the support unit. The two cables are slidably disposed about the intermediate unit via a first pair of pulleys and a second pair of pulleys, which are attached to the intermediate unit. Thus, the pulley system of the present invention allows for the extension and retraction of the support unit via the extension and retraction of the intermediate unit. The pulley system enables the support unit to be raised to a height above the intermediate unit. The pulley system further functions to retract the support mechanism, in an active and controlled manner, when the intermediate unit is retracted by the reversible motor, which is attached to the drive screw.

While Phoenix does disclose movement of a platform via a combined drive screw and chain and sprocket mechanism, Phoenix does not disclose the novel pulley and cable arrangement for movement of a support unit in relation to an intermediate unit, as described in the present invention. Specifically, Phoenix does not disclose two cables, each cable having two cable ends fastened to the base unit. Rather, Phoenix discloses a chain that is attached at a first

end to a base and at a second end to a support bushing that slides on a second vertical rod. If the vertical rod bushing and connector mechanism of Phoenix can be considered analogous to the intermediate unit of the present invention, then the chain of Phoenix is attached at a first end to the base and at a second end to an intermediate unit rather than to an upper and lower end of the base unit, as disclosed by the present invention.

Phoenix also does not disclose a first pair of pulleys fastened to the intermediate unit and a second pair of pulleys fastened to the intermediate unit. Rather, Phoenix discloses a single sprocket rotably mounted to each of the second pair of vertical bars and a chain for engaging the sprocket.

Phoenix additionally does not disclose two cables fastened along their length to the support, thereby allowing for the extension and retraction of the support unit via the intermediate unit. Rather, the chain of Phoenix is attached to the base at one end and to a second support brushing at the other end. The platform or support of Phoenix is also attached to the second brushing and moves cooperatively with the second brushing. Thus, the chain of Phoenix is not directly attached to the platform or support.

Moreover, the cable and sprocket configuration disclosed in Phoenix does not disclose an active and controlled retraction of the platform. Rather, the single sprocket configuration of Phoenix relies on gravity for passive retraction of the platform to its closed or starting position. In contrast, the pulley system of the present invention, comprises two cables slidably disposed

about the intermediate unit via a first pair of pulleys, the pair of cables, fastened to the base at the cable ends and fastened to the support unit along their respective lengths. The cable pair and pulley pairs works in cooperation to actively retract the support unit in a controlled manner when the intermediate unit is retracted by the reversible motor. It is important that the extension and retraction be active and controlled, i.e. not dependant on gravity, so that the support unit may be extended and retracted even if the weight of a flat panel monitor causes the support unit to tilt several degrees from normal (90 degrees).

The present invention further claims movement of an intermediate unit via a single drive screw. The single drive screw feature provides for a compact storage device. The motor is fastened to the base unit and coupled to a drive screw. The drive screw is secured to the base unit and secured to the intermediate unit, thereby communicating linear movement to the intermediate unit via rotation of the drive screw. Phoenix does not disclose movement of a support unit via a single drive screw. Rather, movement of the Phoenix platform requires a pair of threaded vertical rods, which are moved in synchrony by the motor.

Accordingly, for at least these reasons, Phoenix fails to anticipate or obviate the present invention.

Applicant respectfully submits that the combination of Rasmussen and Phoenix would not render the present invention obvious because the combination fails to disclose all of the features of the present invention. Thus, even if Rasmussen, directed to an elevating and support

apparatus having a single motor driven screw, were somehow combined with Phoenix, directed to a combined motor and pulley system for movement of a support, the combination still fails to disclose the novel cable and pulley arrangement for movement of a support unit in relation to an intermediate unit. Specifically, the combination of Rasmussen and Phoenix fails to show both a pair of pulleys, fastened to the intermediate unit, and a pair of cables, fastened to the base at the cable ends and fastened to the support unit along their respective lengths. Thus, the combination of Rasmussen and Phoenix fails to disclose active and controlled extension and retraction of the support unit, as disclosed in the present application.

Applicant respectfully submits that the combination of Watt and Phoenix would similarly fail to render the present invention obvious because the combination fails to disclose all of the features of the present invention. Were Watt, directed to platform mounted on a pair of guide shafts and raised and lowered by means of a drive shaft somehow combined with Phoenix, directed to a combined motor and pulley system for movement of a support, the combination fails to disclose the novel cable arrangement for movement of a support unit in relation to an intermediate unit. Specifically, the combination of Watt and Phoenix fails to show both a pair of pulleys, fastened to the intermediate unit, and a pair of cables, fastened to the base at the cable ends and fastened to the support unit along their respective lengths. Thus, the combination of Watt and Phoenix fails to disclose active and controlled extension and retraction of the support unit, as disclosed in the present application.

## **SUMMARY**

None of the above-cited references disclose a lifting device as claimed in the present invention. The present invention discloses several novel features, which clearly define over the prior art. These features include, but are not limited to a pulley system comprising a pair of cables and two pairs of pulleys. Each cable of the cable pair is arranged about one side of the drive screw. The two ends of each cable are fastened to the base unit. Each cable is further fastened to the support unit. The two cables are slidably disposed about the intermediate unit. The pulley system functions to extend and retract the support unit in relation to the intermediate unit in a controlled and active manner.

Accordingly, Applicant respectfully submits that the present invention is neither anticipated nor rendered obvious by the cited references. Applicant respectfully requests favorable consideration and that this application be passed to allowance. An early and favorable action on the merits is earnestly solicited.

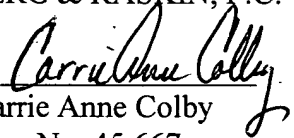
Applicant's representative believes that this response is being filed in a timely manner. In the event that any extension and/or fee is required for the entry of this amendment the Commissioner is hereby authorized to charge said fee to Deposit Account No. 50-0518 in the

name of Steinberg & Raskin, P.C.

Respectfully submitted,

STEINBERG & RASKIN, P.C.

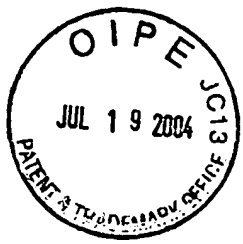
By: \_\_\_\_\_

  
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## **NON-PROVISIONAL APPLICATION**

### **CROSS REFERENCE TO RELATED APPLICATIONS**

None.

### **FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT**

None.

### **TITLE**

Compound Lift Device

### **BACKGROUND OF THE INVENTION**

#### **1. Field of the Invention**

The present invention generally relates to a motorized lift. Specifically, the invention is a compound lift capable of extending a low-profile television from and retracting a low-profile television into a storage cabinet so as to provide volume efficient storage.

#### **2. Description of the Related Art**

Television design trends are now focused on low-profile devices including but not limited to plasma screens and LCD panels. Low-profile televisions maximize viewing area and minimize unit depth. However, designs are inherently less decorative, less stable, and heavier than conventional televisions.

Aesthetic and stability deficiencies of low-profile televisions are addressed by housing the television within a cabinet. In such applications, the low-profile television is extended from and retracted into the cabinet via a lift.

While lifts are known within the art, the height of such devices greatly

exceeds that of the low-profile television. As such, cabinet dimensions are dictated by the lift envelope rather than by the size of the television thereby favoring volumetrically inefficient designs. Larger cabinets are less desirous in residential settings due to floor space constraints. Furthermore, such cabinets place the television at a height that is less than optimal for viewing conditions within residential settings.

What is currently required is a lift device that is compact and provides for the compact storage of a low-profile television.

What is required is a lift device capable of extending a low-profile television to a height conducive to residential applications.

### **SUMMARY OF THE INVENTION**

An object of the present invention is to provide a television lift device of telescoping design so as to provide for the compact storage of both lift and television.

A further object of the present invention is to provide a lift device of telescoping design so as to provide a viewing arrangement compatible with residential use.

The present invention is a compound motorized lift facilitating the uninterrupted and nearly noiseless movement of a low-profile television. The invention is comprised of a base unit, an intermediate unit, and a support unit slidably disposed in a telescoping fashion in the described order. A pair of linearly extensible slides are fastened between base and intermediate units and between intermediate and support units. The intermediate unit is extended and retracted from the base unit in a linear fashion via a motor driven screw. The support unit is extended and retracted in a linear fashion via a cable-pulley arrangement that couples movement of the intermediate unit to the support

unit in a likewise direction.

The base unit is comprised of a plate of planar extent and a first pair of linearly extensible slides separately disposed and parallel. A linear slide is fastened to each length-wise flange along the base unit.

The support unit is comprised of a plate of planar extent and a second pair of linearly extensible slides separately disposed and parallel. A linear slide is fastened to each length-wise flange along the support unit. At least two support elements are adjustably fastened to the support unit so as to facilitate secured attachment of a low-profile display.

The intermediate unit is comprised of a plate of planar extent, a first pair of pulleys attached at one end, and a second pair of pulleys attached along a second end. First and second pairs of linearly extensible slides are separately fastened to the intermediate unit so as to allow movement between intermediate and base units and between support and intermediate units.

A reversible motor is fastened to the base unit and directly coupled to a drive screw. The drive screw is secured to the base unit so as to allow its rotation. The drive screw contacts the intermediate unit thereby imparting linear movement to the intermediate unit via rotation of the drive screw. The intermediate unit extends from and retracts relative to the base unit. The intermediate unit is disposed between base and support units when the compound lift is retracted.

A pair of cables are separately disposed and parallel about the drive screw. Cables are fastened to base and support units and slidably disposed about the intermediate

unit via pulleys. Cables impart movement in a likewise direction to the support unit when the intermediate unit is extended and retracted.

In alternate embodiments, the compound lift device further comprises a limit switch fastened to the base unit and electrically connected to the reversible motor so as to control lift function. The limit switch is attached to a rod extending along the length of the base unit and parallel to the drive screw. The rod is attached to the base unit in a secured fashion thereby allowing for movement along its length. The rod has a mechanical stop to STOP and REVERSE the motor when the compound lift device is retracted and a mechanical stop to STOP and REVERSE the motor when the compound lift device is extended.

In yet other embodiments, the compound lift device further comprises a controller communicating with a rotary motion sensor so as to START, STOP and/or REVERSE the motor based upon the rotational history of the drive screw.

Several advantages are offered by the present invention. The invention minimizes cabinet size thereby reducing weight and cost. The invention enables both extension and retraction of a low-profile television in a smooth, stable, and nearly noiseless fashion. The invention facilitates greater height adjustability thereby accommodating a variety of viewing conditions.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of the present invention showing front of lift when

completely retracted.

FIG. 2 is a perspective view of the present invention showing front of lift when completely extended.

FIG. 3 is a section view of support unit showing attachment of slides and c-channels about flanges along a central plate.

FIG. 4 is an enlarged view showing coupling between horizontal support element and c-channel.

FIG. 5 is an enlarged section view showing coupling between horizontal support element and c-channel.

FIG. 6 is an enlarged view showing coupling between horizontal rest and c-channel.

FIG. 7 is an enlarged section view showing coupling between horizontal rest and c-channel.

FIG. 8 is an elevation view of rear of support element showing attachment scheme fixing cables to bracket and thereby to support unit.

FIG. 9 is an enlarged view of bracket mounted to support unit showing cable secured between u-bolt and cable guide.

FIG. 10 is a perspective view showing rear of lift when extended having a first pair of slides attached between base and intermediate units and a second pair of slides attached between intermediate and support units.

FIG. 11 is a side elevation view of an exemplary linear slide.

FIG. 12 is a section view of slide from FIG. 11 showing linear arrangement of inner and outer arms about ball bearings contacting and supported by a bearing support.

FIG. 13 is an elevation view of front of base unit showing motor attached to a screw lengthwise disposed along the base unit, a rod attached to a limit switch activated by a pair of stops along the rod length, and a pair of cables secured to a flange and contacting a pair of pulleys at one end of the intermediate unit.

FIG. 14 is an enlarged view showing a motor attached to a flange at one end of the base unit and coupled to a drive screw and a limit switch attached to the flange and coupled to a rod having mechanical stops to control motor function.

FIG. 15 is an enlarged view of front of the lower end of the intermediate unit and the upper end of the base unit showing drive screw coupled to a bushing attached to a flange along the intermediate unit.

FIG. 16 is a side section view showing drive screw attachment to a flange at the upper end of the base unit and a flange at the lower end of the intermediate element so that the intermediate unit is movable in a linear fashion when drive screw is rotated.

FIG. 17 is a rear elevation view showing the upper end of the intermediate unit having a pair of pulleys and cables thereon.

FIG. 18 is a schematic diagram showing cable ends attached to flanges along base unit, contact between cable and pulleys at both ends of intermediate unit, and attachment of cable to support unit so that linear movement of the intermediate unit via the drive screw causes likewise linear movement of the support unit via the cable-pulley arrangement.

FIG. 19 is an enlarged view of flange at the lower end of the base element and attachment of cable thereto.

FIG. 20 is an enlarged view of flange at upper end of the base element and attachment of

cable thereto via an adjustable rod arrangement.

FIG. 21 is a block diagram of the motion control circuit for an exemplary embodiment.

### **REFERENCE NUMERALS**

- 1 Compound lift
- 2 Base unit
- 3 Intermediate unit
- 4 Support unit
- 5 Horizontal support
- 6 Holes
- 7 Horizontal rest
- 8 Plate
- 9 Flange
- 10 C-channel
- 11 Slide
- 12 Fastener
- 13 Inner locking plate
- 14 Fastener
- 15 Outer locking plate
- 16 Support bar
- 17 Outer locking plate
- 18 Inner locking plate
- 19 Fastener

- 20 Support plate
- 21 Bracket
- 22 Cable
- 23 Stop
- 24 Cable fastener
- 25 U-bolt
- 26 Cable guide
- 27 Nut
- 28 Fastener
- 29 Ball bearing
- 30 Bracket
- 31 Outer arm
- 32 Bearing support
- 33 Inner arm
- 34 Drive screw
- 35 Flange
- 36 Motor
- 37 Limit switch
- 38 Rod
- 39 Lower stop
- 40 Upper stop
- 41 U-shaped bracket



42 Fastener  
43 Coupler  
45 Nut  
46 Pulley  
47 Flange  
48 First bushing  
49 Fastener  
50 Flange  
51 Stiffener  
52 Plate  
53 Flange  
54 Second bushing  
55 Threaded connector  
57 Flat  
58 Plate  
59 T-shaped connector  
60 Nut  
61 Spring  
62 Flange  
63 First cable end  
64 Second cable end  
66 Wire

70 Low-profile display  
100 Transformer  
101 Socket  
102 Television socket  
103 Remote control receiver  
104 Remote control transmitter  
105 Switch  
106 Controller  
107 Manual control  
108 Rotary motion sensor

### **DESCRIPTION OF THE INVENTION**

Referring now to FIG. 1, an exemplary embodiment of the present invention, namely a compound lift 1 capable of extending and retracting a low-profile display 70, is shown in its retracted position wherein a support unit 4, an intermediate unit 3, and a base unit 2 of comparable lengths are arranged in a telescoping-like fashion so as to conceal the intermediate unit 3 behind support unit 4 and base unit 2 behind intermediate unit 3. FIG. 2 shows the same compound lift 1 having both support unit 4 and intermediate unit 3 extended from the base unit 2. The present invention may be mechanically attached to a storage cabinet via methods and techniques understood in the art.

A variety of application are possible for the present invention. For example, the compound lift 1 may raise a low-profile display 70 above or lower a low-profile display 70 below a cabinet in a vertical fashion. Likewise, the compound lift 1 may

extend a low-profile display 70 in a horizontal fashion from a floor cabinet or wall mounted cabinet. Therefore, reference to top, bottom, upper, lower, upward and downward are for descriptive purposes only and not intended to limit application of the present invention. Fasteners are defined to include screws, bolts, rivets, and other similar devices understood in the art.

Referring again to FIG. 1, the support unit 4 is shown having a pair of horizontal supports 5 and an optional pair of horizontal rests 7 fastened thereto. It is preferred that the horizontal supports 5 have a plurality of holes 6 along their length to accommodate a variety of mounting configurations for commercially available low-profile displays 70.

Referring now to FIG. 3, the support unit 4 is comprised of a planar disposed plate 8 having a flange 9 along both edges parallel to the length of the plate 8. The plate 8 may be composed of a metal and the flanges 9 formed via conventional metal forming techniques. A slide 11 is mounted along the inside and a c-channel 10 mounted along the outside of the flange 9 parallel to the slide 11. Slide 11 and c-channel 10 are secured to the flange 9 via a plurality of fasteners 12. The slide 11 is attached to the flange 9 so as to allow the slide 11 to function in an extendable and retractable fashion.

Referring now to FIGS. 4-5, a horizontal support 5 is shown attached to the c-channel 10. An exemplary horizontal support 5 is comprised of a support bar 16 having a pair of outer locking plates 15 attached thereto, either mechanically fastened or welded, in a perpendicular arrangement. While the outer locking plate 15 may be rectangular shaped, it is preferred to have the outer locking plate 15 angled with respect to the support plate

16, as shown in FIG. 4. An inner locking plate 13 is placed within the c-channel 10, as shown in FIG. 5. Inner locking plate 13 and outer locking plate 15 are co-located along the length of the c-channel 10 and contact the c-channel 10 in a compressive fashion when fastener 14 is threaded through a hole through the inner locking plate 13. The described arrangement fixes the horizontal support 5 to the c-channel 10, however, allows adjustment to the location of the horizontal support 5 along the length of the c-channel 10.

Referring now to FIGS. 6-7, an optional horizontal rest 7 is shown attached to one end of a c-channel 10. The horizontal rest 7 is preferred when additional support is required to secure a low-profile display 70 onto the support unit 4. The exemplary horizontal rest 7 shown in FIG. 7 is comprised of a support plate 20 fastened, welded or otherwise fixed to an outer locking plate 17 in a perpendicular arrangement. The support plate 20 may have one or more holes 6 so as to allow mechanical attachment to a low-profile display 70. The support plate 20 should contact the end of the c-channel 10 so as to prevent rotation of the horizontal rest 7 when supporting load from a low-profile display 70, as represented in FIG. 6. The outer locking plate 17 and an inner locking plate 18 are co-located adjacent to the end of the c-channel 10 and contact the c-channel 10 in a compressive fashion when fastener 19 is engaged through a hole through the inner locking plate 17. The described arrangement fixes the horizontal rest 7 to the c-channel 10, however, allows for its adjustment and removal.

Referring now to FIG. 8, the rear of the support unit 4 is shown having a bracket 21 mechanically fastened or welded thereto. The bracket 21 facilitates the

fastening of a pair of separately disposed but parallel cables 22 to the support unit 4 via cable fasteners 24. The dual cable 22 arrangement allows for extension and retraction of the support unit 4 via extension and retraction of the intermediate unit 3. While bracket 21 location is design dependent, the extended height of the support unit 4 above the intermediate unit 3 is directly related to the distance between bracket 21 and top of support unit 4.

Cable 22 is typically an element having a small cross section, yet sufficiently flexible to allow for small radius bends and sufficiently strong to support the weight of a low-profile display 70. For example, it was preferred to have a cable 22 composed of a bundled arrangement of thin wires. In yet other embodiments, the cable 22 was composed of a flexible metal chain.

Referring now to FIG. 9, an exemplary attachment scheme for cable 22 to plate 8 comprising the support unit 4 is shown in detail. While various hardware schemes are possible, adequate interlock between cable 22 and bracket 21 was achieved by securing the cable 22 between a cable guide 26 having a channel conforming to the shape of the cable 22 and a u-bolt 25. The u-bolt 25 was fastened to bracket 21 and cable guide 26 through a pair of holes separate disposed about the cable 22 passing through each component. A nut 27 was threaded onto the both ends of the u-bolt 25 thereby providing the compression required to secure cable 22 to cable fastener 24 and thereafter to bracket 21.

Referring now to FIG. 10, the present invention is shown with intermediate unit 3 extended from base unit 2 and support unit 4 extended from intermediate unit 3.

Extension and retraction between intermediate unit 3 and support unit 4 and between base unit 2 and intermediate unit 3 is achieved via a pair-wise arrangement of linear slides 11. Each slide 11 is comprised of an outer arm 31 and an inner arm 33. An inner arm 33 is fastened via a plurality of fasteners 28 to the inside of each flange 62 along the base unit 2 as shown in FIG. 10 and to the inside of each flange 9 along the support unit 4 as shown in FIG. 3. Outer arms 31 are fastened to intermediate unit 3 as represented in FIG. 10. Slides 11 separate base unit 2 from intermediate unit 3 and intermediate unit 3 from support unit 4 in an offset fashion so as to prevent interference contact during extension and retraction.

A variety of linearly extensible slides 11 are applicable to the present invention. For example, a slide 11 may be comprised of two movable linear-shaped and interlocking elements having a low-friction polymer there between. However, preferred embodiments consisted of a bearing-based slide 11, as described in FIGS. 11-12. FIG. 11 shows one such slide 11 having an outer arm 31, an inner arm 33 with bracket 30 fastened or welded thereon, and a bearing support 32 with a plurality of pair-wise arranged ball bearings 29.

Referring now to FIG. 12, the outer arm 31 is a u-shaped channel of linear extent. A bearing support 32, also of linear extent, is attached in a fixed fashion to the inside of the outer arm 31 and between outer arm 31 and inner arm 33 so as to secure a plurality of ball bearings 29 along the length of the slide 11. While it is preferred to have both inner arm 33 and outer arm 31 composed of a metal, the bearing support 32 should be composed of a low-friction polymer, including but not limited to

polytetrafluorethylene and polyethylene. Ball bearings 29 were positioned along the bearing support 32 in holes of like-size dimension so as to allow for their rotation within the holes when inner arm 33 traverses the length of the outer arm 31. A plurality of holes 6 were provided along the length of the outer arm 31 to facilitate attachment with flange 9 along the support unit 4 and with flange 62 along the base unit 2 via fasteners 28, as shown in FIG. 10. A plurality of holes 6 are also provided along the length of the bracket 30 so as to facilitate attachment between slides 11 and intermediate unit 3 via fasteners 28 along the planar surface of the intermediate unit 3, also shown in FIG. 10.

Referring now to FIG. 13, the front of the base unit 2 is shown having a motor 36 at one end and a drive screw 34 along its length. Also shown is a slide 11 fastened to the inside of each of two flanges 62 disposed along the length of the base unit 2 and perpendicular to the plate 58. A flange 35 is located adjacent to the lower end. A fourth flange 53 is located along the upper end adjacent to the intermediate unit 3 attached to and perpendicular to the plate 58, as represented in FIG. 16. Flanges 62 are either welded, mechanically fastened or fabricated using metal shaping techniques. Likewise shown is a pair of cables 22 traversing the length of the base unit 2 and parallel about the drive screw 34.

The motor 36 is attached via several fasteners 42 to the flange 35 at the lower end of the base unit 2, as shown in FIG 14. While various motor 36 types are applicable to the present invention, preferred embodiments were reversible and DC powered. One specific example being a 24V motor, model number 403.979 manufactured by Valeo Auto-Electric Wischer und Motoren GmbH (Motors and Actuators Division) with an

office at Stuttgarter Strasse 119 D-74321 Bietigheim, Germany.

The motor 36 is directly coupled to the drive screw 34 via a coupler 43 thereby locking the rotational shaft of the motor 36 to the drive screw 34. The coupler 43 is a metal cylinder having a cavity conforming to the end of both motor shaft and drive screw 34. A u-shaped bracket 41 is positioned above the motor 36, adjacent to the coupler 43, and welded to both plate 58 and flange 35. The u-shaped bracket 41 has a hole of slightly larger size than the drive screw 34 so as to allow its rotation yet provide lateral support to the drive screw 34.

Referring again to FIG. 13, an optional rod 38 is provided parallel to the drive screw 34 along the length of the base unit 2. The rod 38 passes through a hole in an unobstructed manner along the flange 35 at the lower end of the base unit 2 and the flange 50 at the lower end of the intermediate unit 3. A lower stop 39 is secured to the rod 38 via a set screw above the flange 35 attached to the base unit 2. A spring 61 is positioned along the length of the rod 38 between lower stop 39 and flange 35 and depressed by a stop 23 when compound lift 1 is retracted, as shown in FIG. 14. An upper stop 40 is likewise secured to the rod 38 via a set screw above the flange 50 along the intermediate unit 3. Stop 23, lower stop 39 and upper stop 40 are cylinder shaped elements disposed about the rod 38. The limit switch 37 is fastened to the flange 35 via at least one nut 45, also shown in FIG. 14. The rod 38 is mechanically attached to the optional limit switch 37 below the flange 35, as shown in FIGS. 13-14.

While limit switches 37 are understood within the art, preferred embodiments of the present invention included a mechanically activated two position electrical device.



The limit switch 37 is electrically connected to the motor 36 through a controller 106 or directly via a wire 66 shown in FIG.1.

Interaction between flange 50 and lower stop 39 or upper stop 40 communicates the location of the intermediate unit 3 along its travel length to the limit switch 37. For example, contact between lower stop 39 and flange 50 during retraction moves the rod 38 in a downward direction so as to mechanically trip the limit switch 37 thereby terminating power to the motor 36 and reversing the rotation of motor 36 and drive screw 34 attached thereto. Likewise, contact between upper stop 40 and flange 50 during extension moves the rod 38 in an upward direction so as to mechanically trip the limit switch 37 thereby terminating power to motor 36 and again reversing the rotation of motor 36 and drive screw 34.

Flanges 47, 50 are located at either end of the planar dispose plate 52 comprising the intermediate unit 3 and may be located to the same side or opposite sides of the plate 52. Plate 52 may be composed of a metal and the flanges 47, 50 formed via conventional metal forming techniques. Referring now to FIG. 15, a stiffener 51, typically a hollow beam or u-shaped element, is mechanically fastened to the plate 52 in a lengthwise fashion so as to resist deflection of the intermediate unit 3 during extension and retraction.

Referring again to FIG. 15, the drive screw 34 is shown passing through a first bushing 48 mechanically secured to the flange 50 via a pair of fasteners 49. Flange 50 also supports a pair of pulleys 46 oriented in a downward fashion, also mechanically fastened thereto. The upper end of the intermediate unit 3 has a pair of pulleys 46 oriented

in an upward direction attached to a flange 47 of identical design and arrangement as in flange 50, as shown in FIG. 17. Pulleys 46 are angled in an inward direction to minimize their protrusion beyond the flanges 47, 50, yet allowing sufficient distance between cables 22 and flanges 47, 50 to avoid their contact. Pulleys 46 and their fastening are understood in the art.

Referring now to FIG. 16, the end of the drive screw 34 is mechanically secured to the flange 53 at the upper end of the base unit 2 via a second bushing 54. It is preferred that the drive screw 34 not have threads along its length contacting the second bushing 54. The second bushing 54 is composed of a low-friction material, preferably a polymer, allowing the drive screw 34 to freely rotate in a secured fashion. The second bushing 54 is held in place via an interference fit between second bushing 54 and hole through flange 53.

Referring again to FIG. 16, rotation of the drive screw 34 is communicated to the intermediate unit 3 via the first bushing 48. First bushing 48 is secured to the flange 50 at the bottom of the intermediate unit 3 between a pair of pulleys 46. A flat 57 is located along one edge of the first bushing 48 so as to contact the plate 52 and prevent rotation of the first bushing 48 when drive screw 34 rotates. Unlike the second bushing 54 described above, the first bushing 48 is preferred to be composed of a low-friction metal, one example being brass, having a thread pattern of likewise design to engage the thread pattern along the drive screw 34. Rotation of the drive screw 34 is transferred to the first bushing 48 so as to move the intermediate unit 3 attached thereto in a linear fashion along the length of the drive screw 34.

While movement of the intermediate unit 3 is via the drive screw 34, movement of the support unit 4 is via cables 22. Referring now to FIG. 18 shows a schematic diagram describing the arrangement of a cable 22 about one side of the drive screw 34. One end of the cable 22 is fastened to the flange 35 at the lower end of the base unit 2 and vertically aligned upward so to contact a pulley 46 fastened to the flange 47 at the upper end of the intermediate unit 3. Thereafter, the cable 22 is vertically aligned downward so to contact a pulley 46 fastened to the flange 50 at the lower end of the intermediate unit 3. The path of the cable 22 effectively encircles the intermediate unit 3 and contact is effected via a pair of pulleys 46 along one side of the drive screw 34, as graphically represented in FIG. 18. Thereafter, the end of the cable 22 is fastened to a second flange 53 at the upper end of the base unit 2. The cable 22 is fixed to the rear of the support unit 4 via a cable fastener 24, as described above. The described arrangement is required along both sides of the drive screw 34 to effect coupled movement between intermediate unit 3 and support unit 4.

Referring now to FIG. 19, the first cable end 63 is terminated by a t-shaped connector 59 crimped, mechanically fastened or welded to the cable 22. The t-shaped connector 59 either resides within a hole or slot along the flange 35 at the lower end of the base unit 2 thereby securing it to the compound lift 1, as shown in FIG. 14.

Referring now to FIG. 20, the second cable end 64 is terminated by a threaded connector 55 also crimped, mechanically fastened or welded to the cable 22. The threaded connector 55 partially traverses a hole within the flange 53 at the upper end of the base unit 2. A nut 60 is threaded onto the threaded connector 55 and tighten so as to remove

slack along the length of the cable 22.

Referring now to FIG. 21, a block diagram describes the control function of the motor 36 and hence extension and retraction of both intermediate unit 3 and support unit 4. A controller 106 is electrically connected between a transformer 100 and a motor 36, all such devices being understood in the art. The transform 100 receives AC power via a power cord thereafter converting it to DC before communicating it to the motor 36.

STOP, START, and REVERSE, are communicated to the controller 106 via one or more means. For example, a remote control transmitter 104 may communicate wireless commands to a remote control receiver 103 electrically connected to the controller 106. It is likewise possible to communicate commands via a switch 105, one example being the limit switch 37 as described above, or other manual control 107, one example being a toggle switch, electrically connected to the controller 106. Furthermore, it is possible to employ a rotary motion sensor 108 which counts the number of rotations and rotational direction of the drive screw 34 so as to map the rotational history of the drive screw 34. The components for such arrangements are understood in the art.

The controller 106 may also control power flow to one more sockets. For example, a television socket 102 may be electrically connected to the controller 106 so that power is automatically communicated to a low-profile display 70 when the compound lift 1 is fully extended and terminate power when retracting. Likewise, it is possible to have an socket 101 electrically connected to the controller 106 so as to provide power to a VCR or DVD when the compound lift 1 is extended or terminate power when retracting.

The description above indicates that a great degree of flexibility is offered in terms of the present invention. Although the present invention has been described in considerable detail with reference to certain preferred versions thereof, other versions are possible. Therefore, the spirit and scope of the appended claims should not be limited to the description of the preferred versions contained herein.

## CLAIMS

What is claimed is:

1. A compound lift device for controlled movement of a low-profile display comprising:

(a) a base unit of planar extent having a first pair of linearly extensible slides separately disposed and parallel, one each of said first pair of linearly extensible slides fastened to a flange along length of said base unit;

(b) a support unit of planar extent having a second pair of linearly extensible slides separately disposed and parallel, one each of said second pair of linearly extensible slides fastened to a flange along length of said support unit, said support unit having at least two support elements adjustably fastened thereto so as to facilitate secured attachment of said low-profile display;

(c) an intermediate unit of planar extent having a first pair of pulleys attached at one end and a second pair of pulleys attached at another end, said first pair of linearly extensible slides and said second pair of linearly extensible slides separately fastened to said intermediate unit so as to allow movement between said intermediate unit and said base unit and between said support unit and said intermediate unit, said intermediate unit sufficiently stiff so as to resist deflection of said intermediate unit during extension and retraction;

(d) a reversible motor fastened to said base unit and directly coupled to a drive screw, said drive screw secured to said base unit so as to allow its rotation, said drive screw contacting said intermediate unit thereby communicating linear movement to said intermediate unit via rotation of said drive screw, said intermediate unit extending

and retracting with respect to said base unit, said intermediate unit disposed between said base unit and said support unit when said compound lift device is retracted; and

(e) two cables separately disposed about and parallel to said drive screw, said two cables each having two cable ends fastened to said base unit, said two cables fastened along its length to said support unit, said two cables slidably disposed about said intermediate unit via said first pair of pulleys and said second pair of pulleys, said two cables imparting likewise movement to said support unit when said intermediate unit is extended and retracted.

2. The compound lift device of claim 1, further comprising:

(f) a limit switch fastened to said base unit, said limit switch electrically connected to said reversible motor or a controller so as to control function, said limit switch having a rod extending along said base unit, parallel to said drive screw, and attached to said base unit in a movable fashion, said rod having a lower stop to stop and reverse said motor when said compound lift device is retracted and an upper stop to stop and reverse said motor when said compound lift device is extended.

3. The compound lift device of claim 1, further comprising:

(f) a rotary motion sensor adjacent to said drive screw and communicating with said controller so as to stop and reverse said motor based on rotational history of said drive screw.

4. A method for extending and retracting a compound lift device comprising the steps of:

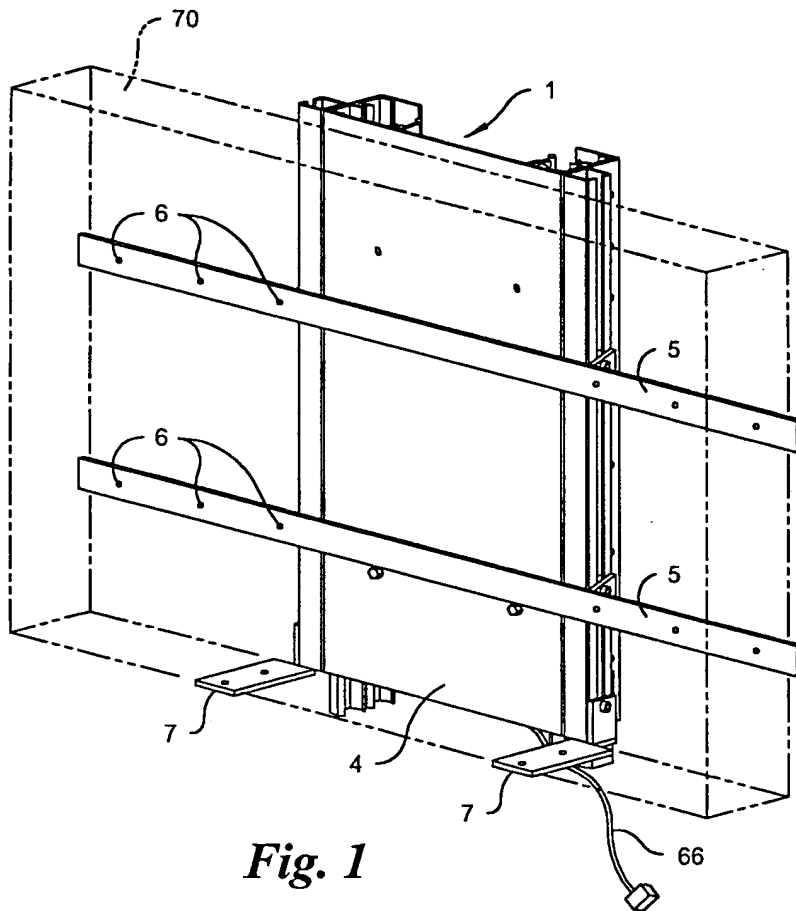
(a) coupling rotational motion of a drive screw to a first extensible unit so as to cause linear movement of said first extensible unit; and

(b) coupling linear movement of said first extensible unit to a second extensible unit in a likewise linear fashion via a cable-pulley arrangement.

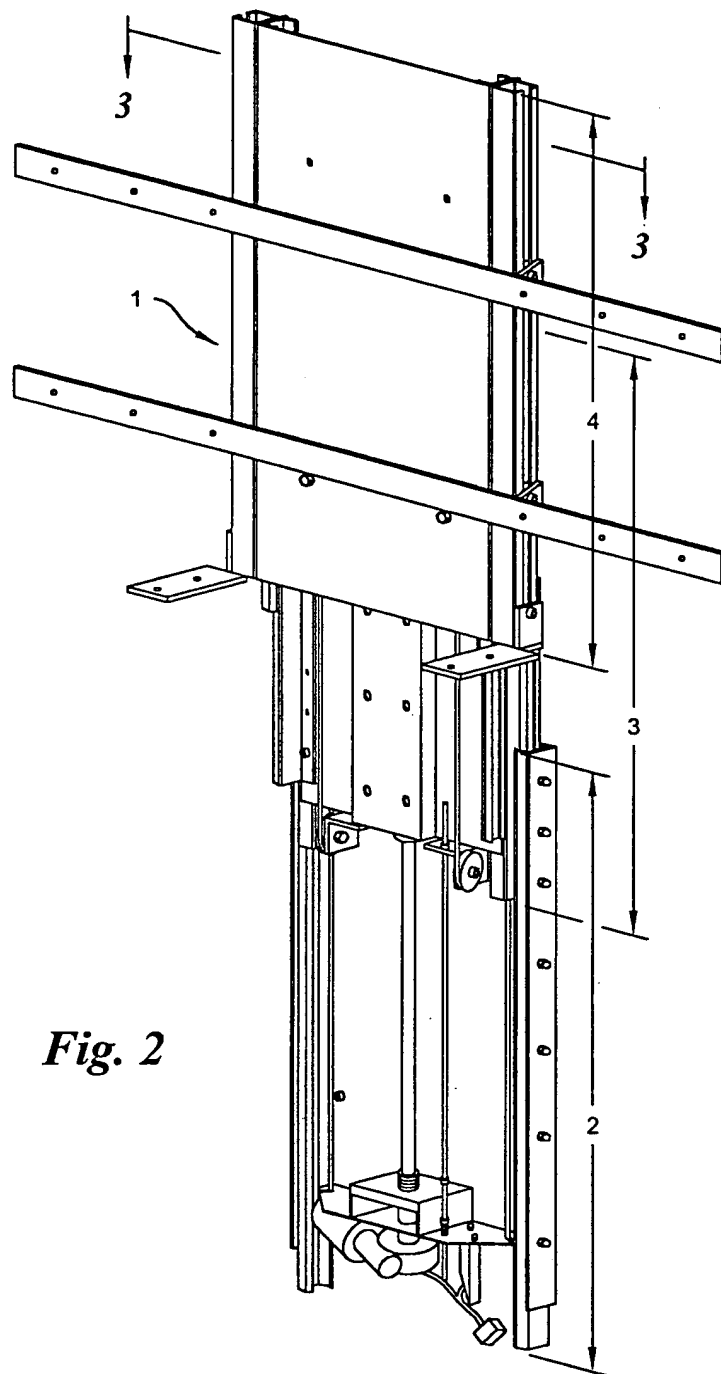


## **ABSTRACT**

The present invention is a compound motorized lift device facilitating the uninterrupted and nearly noiseless movement of a low-profile television. The invention is comprised of a base unit, an intermediate unit, and a support unit slidably disposed in a telescoping fashion in the described order. A pair of linearly extensible slides are fastened between base and intermediate units and between intermediate and support units. The intermediate unit is extended and retracted with respect to the base unit in a linear fashion via a motor driven screw. The support unit is extended and retracted in a linear fashion via a cable-pulley arrangement that couples motion by the intermediate unit in a likewise direction to the support unit.

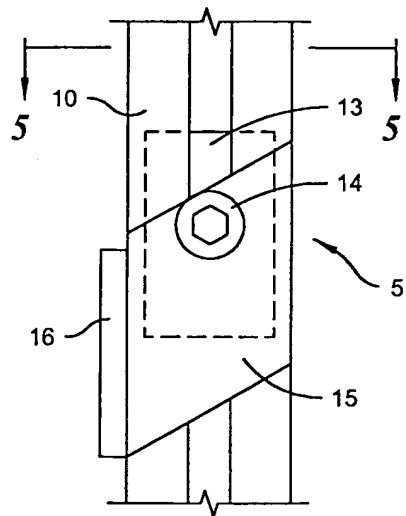
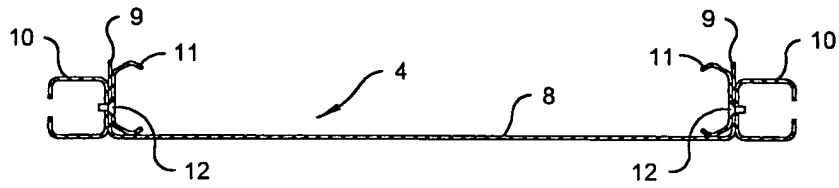


**Fig. 1**



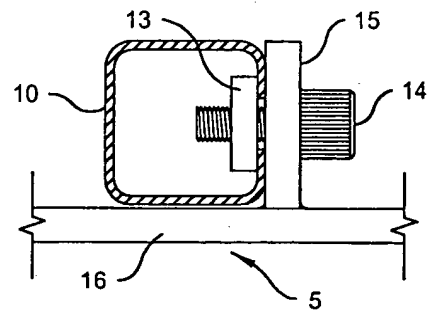
**Fig. 2**

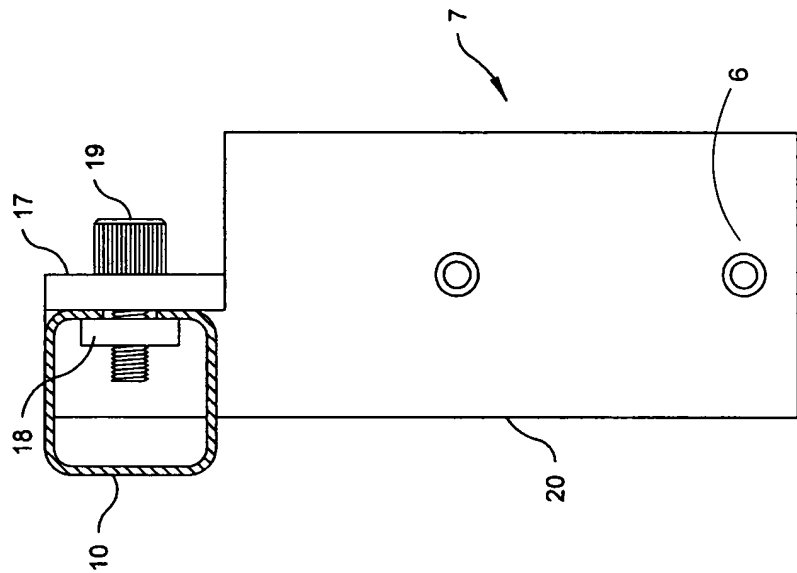
**Fig. 3**



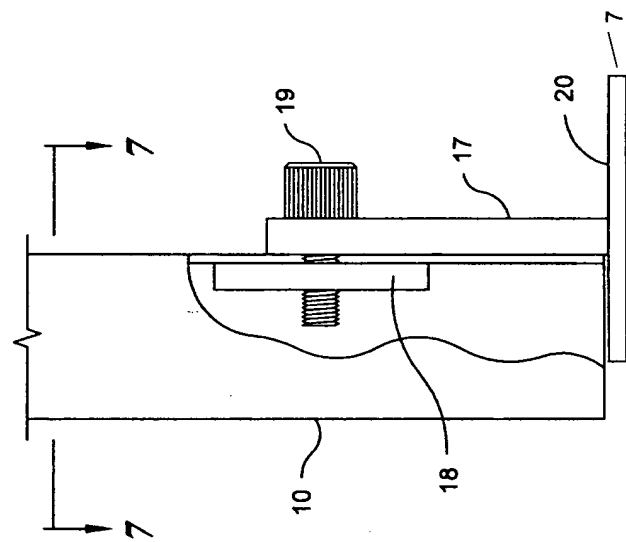
**Fig. 4**

**Fig. 5**

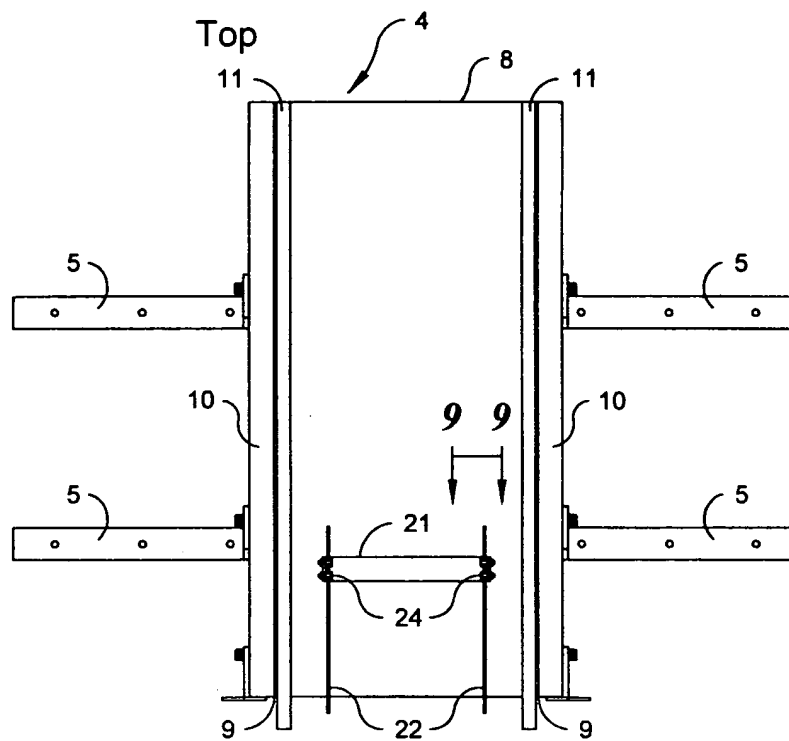




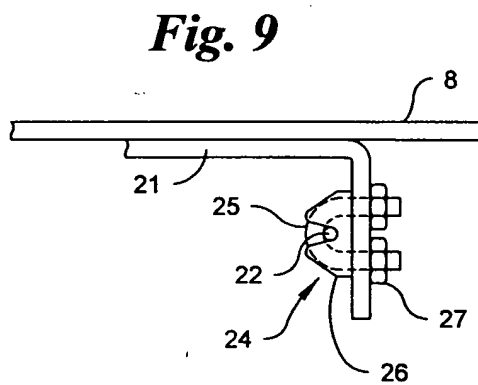
**Fig. 7**



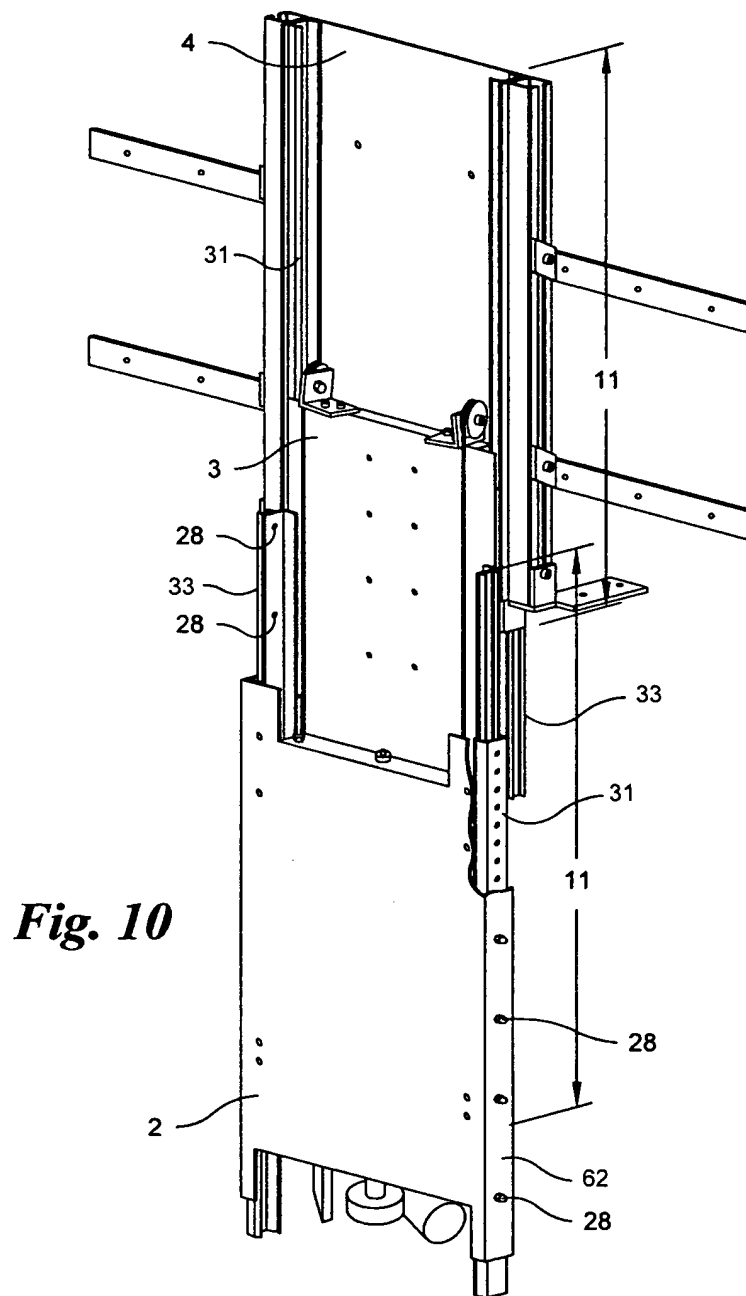
**Fig. 6**



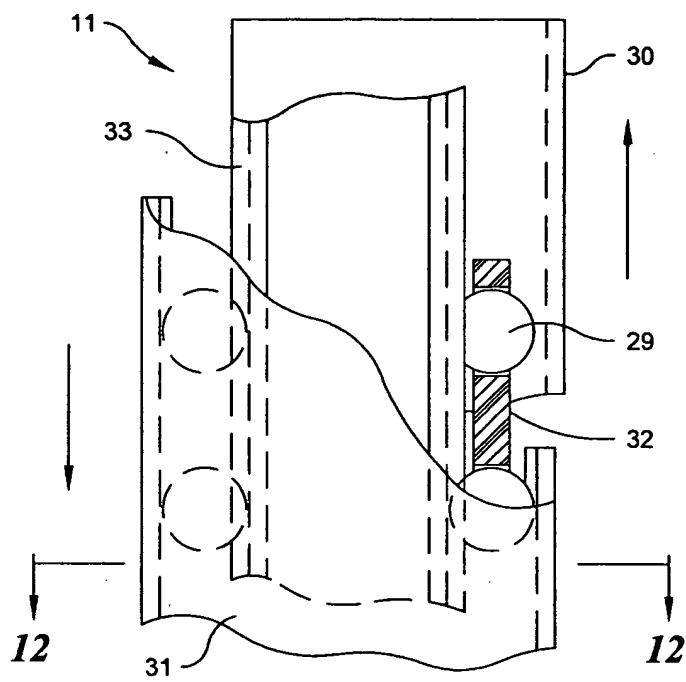
**Fig. 8**



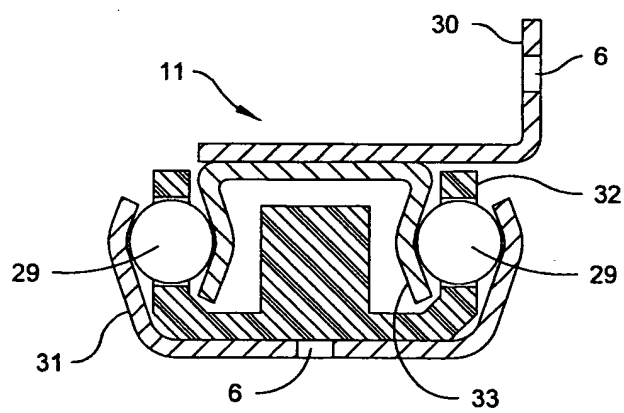
**Fig. 9**



**Fig. 10**

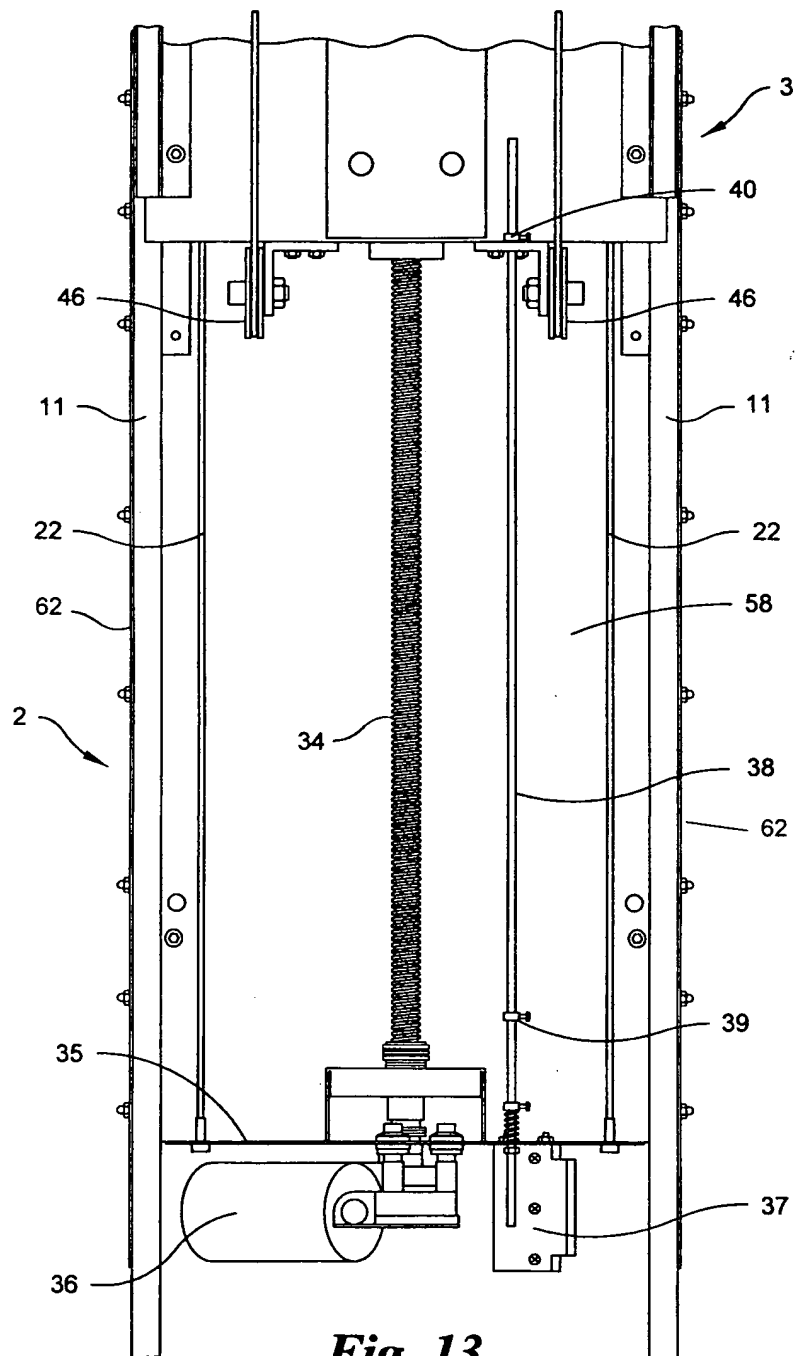


**Fig. 11**

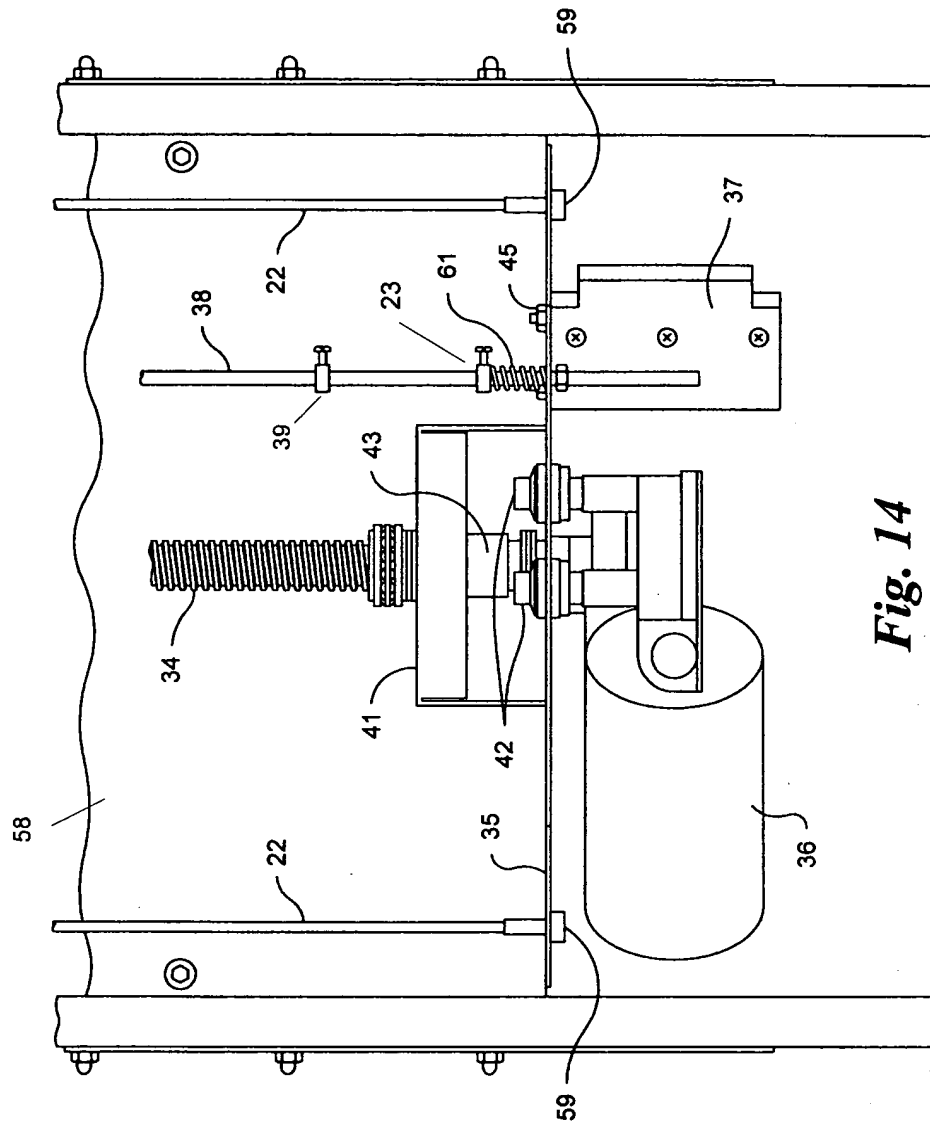


**Fig. 12**



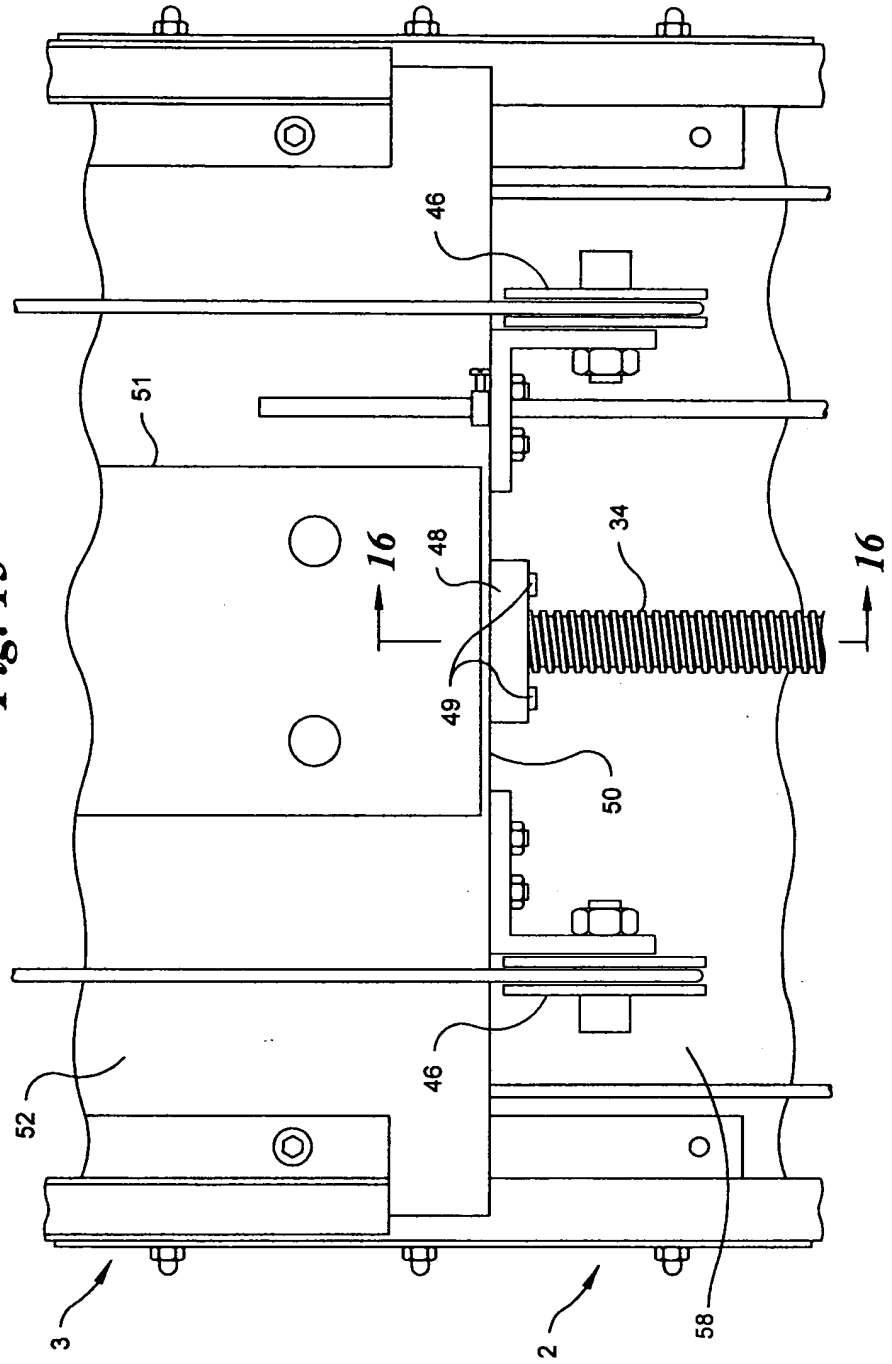


**Fig. 13**

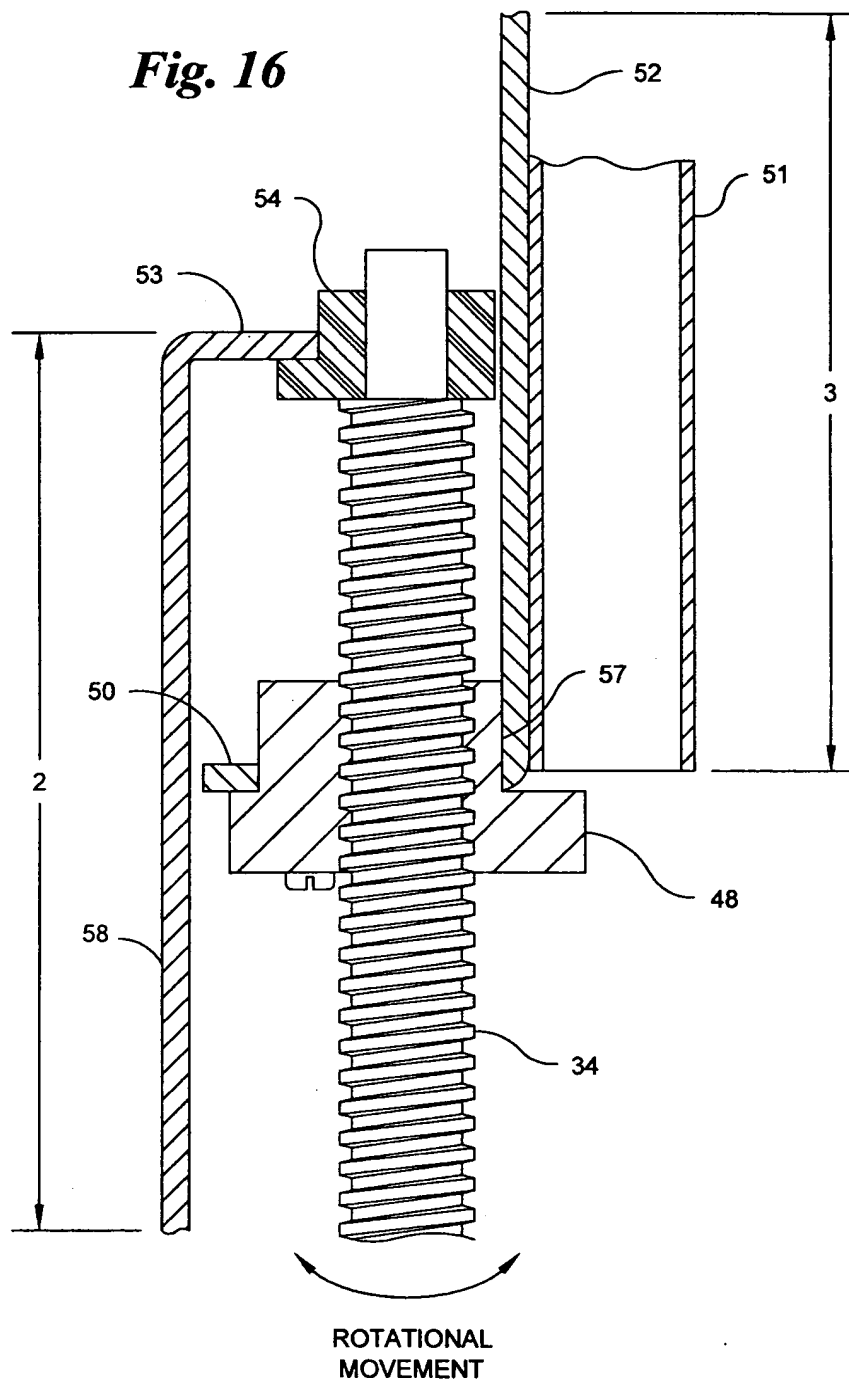


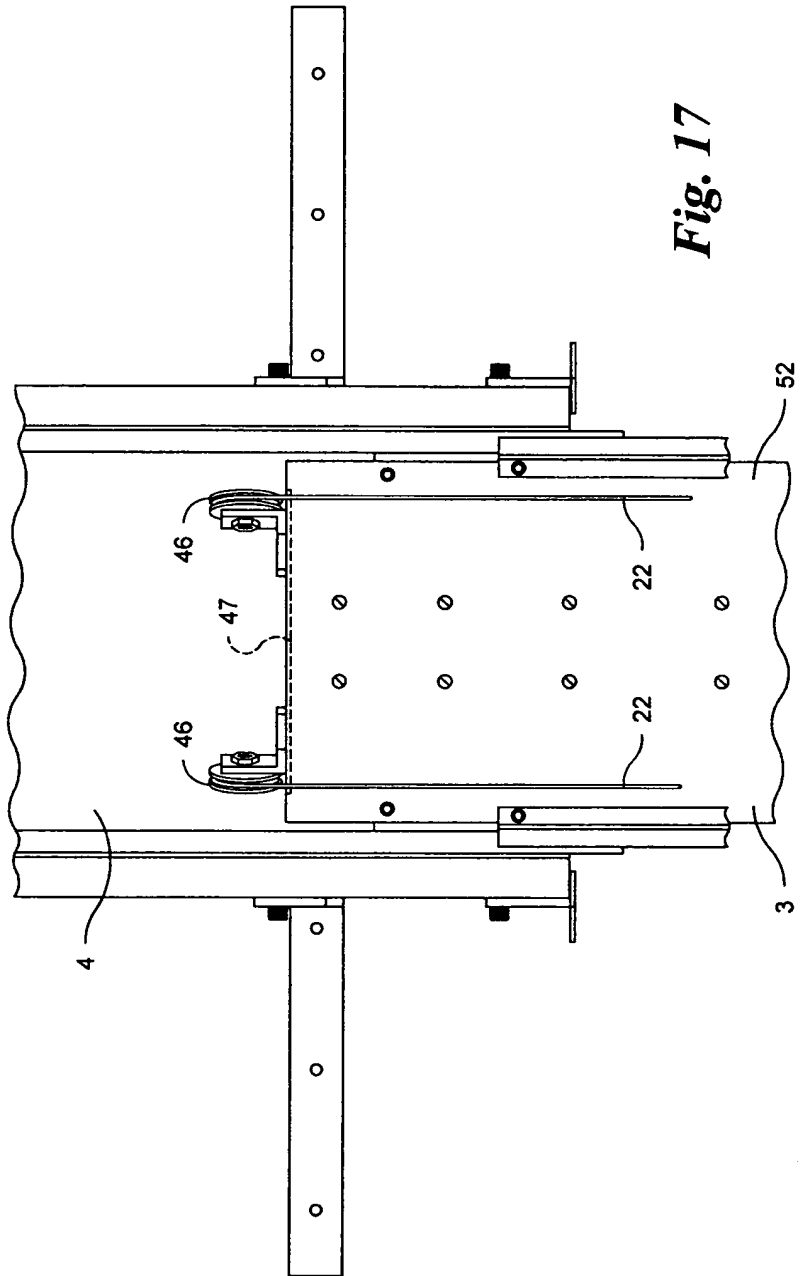
**Fig. 14**

Fig. 15

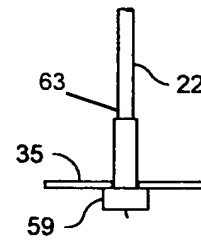
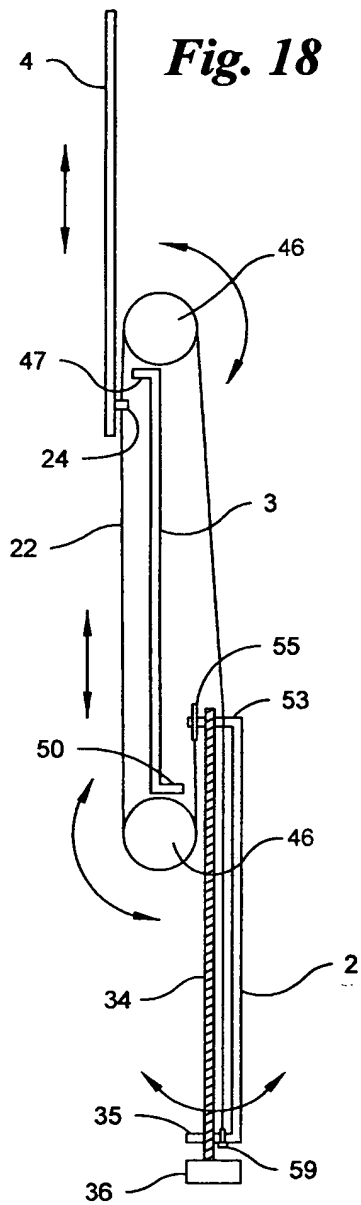


**Fig. 16**

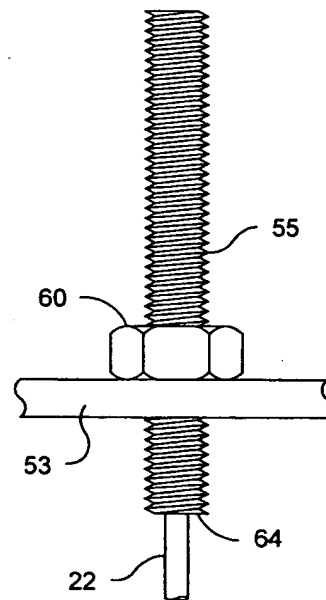




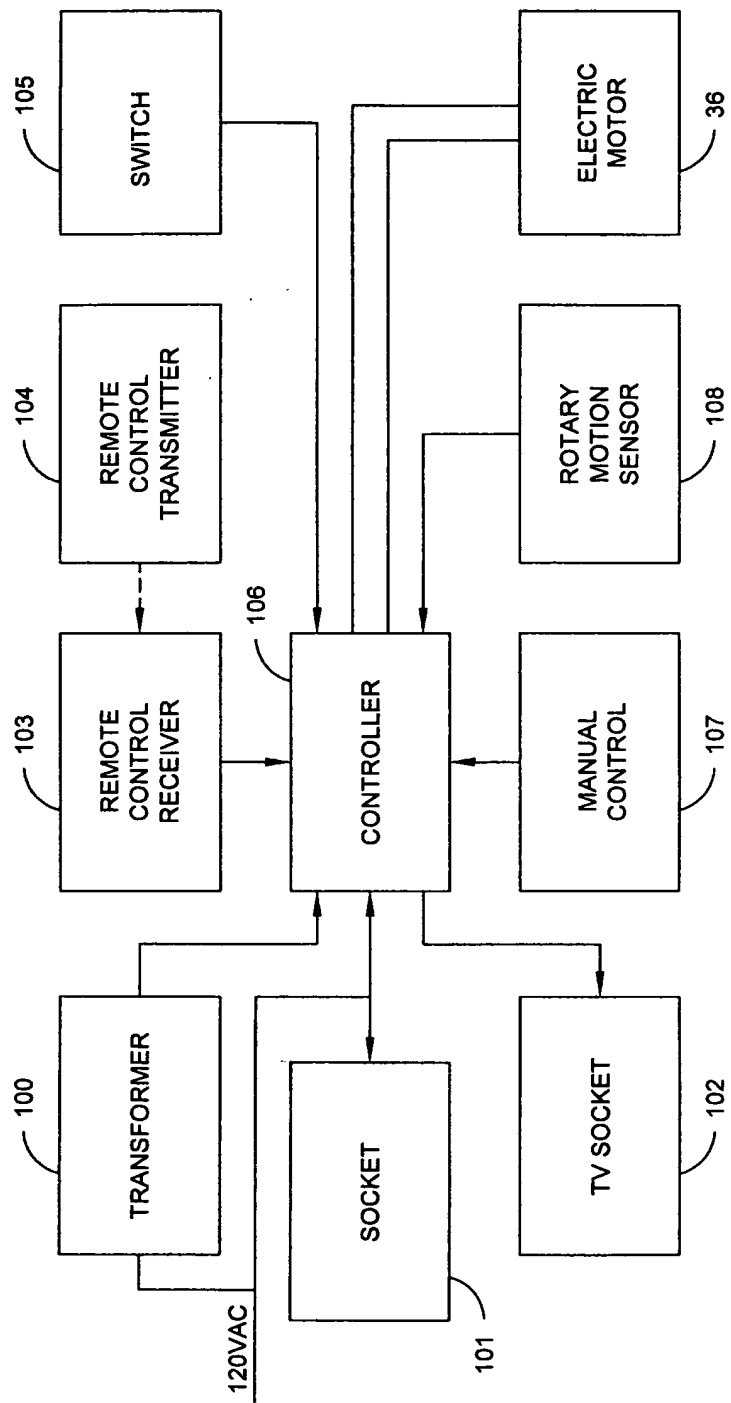
**Fig. 17**



**Fig. 19**



**Fig. 20**



*Fig. 21*